

Homework from § 2.2 / # 31, 32, 33

$$\lim_{x \rightarrow 0.5} \frac{-16x^2 + 29x - 10.5}{x - 0.5} = (\text{substitution}) = \frac{-16\left(\frac{1}{4}\right) + 29\left(\frac{1}{2}\right) - 10.5}{0.5 - 0.5} = \frac{0}{0} [= \text{IDK}]$$

so...

$$\begin{array}{r} \phantom{x-0.5)} \phantom{-16x^2+29x-10.5} -16x+21 \\ \phantom{x-0.5)} \phantom{-16x^2+29x-10.5} \underline{-16x^2+29x-10.5} \\ \phantom{x-0.5)} \phantom{-16x^2+29x-10.5} -16x^2+8x \end{array}$$

31)

$$\begin{array}{r} \phantom{0+21x-10.5} \phantom{0+21x-10.5} \phantom{0+21x-10.5} \\ \phantom{0+21x-10.5} \phantom{0+21x-10.5} \phantom{0+21x-10.5} \underline{\phantom{0+21x-10.5} \phantom{0+21x-10.5} \phantom{0+21x-10.5}} \\ \phantom{0+21x-10.5} \phantom{0+21x-10.5} \phantom{0+21x-10.5} 0 \end{array}$$

so...

$$\lim_{x \rightarrow 0.5} \frac{-16x^2 + 29x - 10.5}{x - 0.5} = \lim_{x \rightarrow 0.5} -16x + 21 = (\text{substitution}) = -8 + 21 = 13$$


---

32) Let  $s(t) = -16t^2 + 29t + 6$ . Find ...

$$\lim_{t \rightarrow 1.5} \frac{s(t) - s(1.5)}{t - 1.5} = (\text{substitution}) = \frac{0}{0} [= \text{IDK} \dots]. \text{ So ...}$$

$$\lim_{t \rightarrow 1.5} \frac{s(t) - s(1.5)}{t - 1.5} = \lim_{t \rightarrow 1.5} \frac{(-16t^2 + 29t + 6) - s(1.5)}{t - 1.5} = \lim_{t \rightarrow 1.5} \frac{(-16t^2 + 29t + 6) - (13.5)}{t - 1.5} =$$

$$\lim_{t \rightarrow 1.5} \frac{(-16t^2 + 29t - 7.5)}{t - 1.5} = \frac{0}{0} [= \text{IDK}]$$

so...

$$\begin{array}{r} \phantom{t-1.5)} \phantom{-16t^2+29t-7.5} -16t+5 \\ \phantom{t-1.5)} \phantom{-16t^2+29t-7.5} \underline{-16t^2+29t-7.5} \\ \phantom{t-1.5)} \phantom{-16t^2+29t-7.5} -16t^2+24t \\ \phantom{t-1.5)} \phantom{-16t^2+29t-7.5} \underline{\phantom{-16t^2+29t-7.5} \phantom{-16t^2+29t-7.5} \phantom{-16t^2+29t-7.5}} \\ \phantom{t-1.5)} \phantom{-16t^2+29t-7.5} 0+5t-7.5 \\ \phantom{t-1.5)} \phantom{-16t^2+29t-7.5} \underline{\phantom{0+5t-7.5} \phantom{0+5t-7.5} \phantom{0+5t-7.5}} \\ \phantom{t-1.5)} \phantom{-16t^2+29t-7.5} 5t-7.5 \\ \phantom{t-1.5)} \phantom{-16t^2+29t-7.5} \underline{\phantom{5t-7.5} \phantom{5t-7.5} \phantom{5t-7.5}} \\ \phantom{t-1.5)} \phantom{-16t^2+29t-7.5} 0 \end{array}$$

$$\text{so...} \lim_{t \rightarrow 1.5} \frac{(-16t^2 + 29t - 7.5)}{t - 1.5} = \lim_{t \rightarrow 1.5} (-16t + 5) = -24 + 5 = -19$$

33) Let  $f(x) = \begin{cases} x-1, & x \leq 3 \\ 3x-7, & x > 3 \end{cases}$ . Find all three limits at  $x = 3$ .

$\lim_{x \rightarrow 3^-} f(x)$ : Since you are only interested in  $x$  values *less than* 3, we use the first rule

$(x - 1)$ . Substituting yields  $(3 - 1) = 2$ .

$\lim_{x \rightarrow 3^+} f(x)$ : Since you are only interested in  $x$  values *greater than* 3, we use the second

rule  $(3x - 7)$ . Substituting yields  $(3 \cdot 3 - 7) = 9 - 7 = 2$ .

$\lim_{x \rightarrow 3} f(x)$ : Since both one-sided limits are equal to 2, the two-sided limit exists, and also equals 2.